

## NOTICES \*

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]In this invention, it is related with a light filter.

Therefore, transmissivity is high to especially a visible ray region, and it is related with the light filter which intercepts efficiently an 800 to 1200-nm near infrared ray, and is suitable for intercepting the infrared rays emitted from the front face of a plasma display (it abbreviates to PDP hereafter).

[0002]

[Description of the Prior Art]Conventionally, the thing as shown below has been widely used for the heat absorbing filter and the filter for video camera spectral-luminous-efficacy amendment.

\*\* The filters which contained metal ions, such as copper and iron, on phosphoric acid system glass (JP,60-235740,A, JP,62-153144,A, etc.).

\*\* The interference filters which make specific wavelength penetrate by laminating the layer from which a refractive index differs and making the transmitted light interfere on a substrate (JP,55-21091,A, JP,59-184745,A, etc.).

\*\* The acrylic resin filter which contains a copper ion in a copolymer (JP,6-324213,A).

\*\* The filters of composition of having distributed coloring matter to binder resin (JP,57-21458,A, JP,57-198413,A, JP,60-43605,A, a special playback common No. 838855 [ nine to ] gazette, JP,11-116826,A, etc.).

[0003]

[Problem(s) to be Solved by the Invention]However, there is a problem as shown below, respectively in the above-mentioned infrared absorption filter.

[0004]In the method of the aforementioned \*\*, although a near infrared region has absorption steeply and the infrared interception rate is dramatically good, a part of red visible region is absorbed greatly, and a transmission color looks blue. It is difficult for thinking color balance as important for a display use and using it in such a case. Since it is glass, there is a problem also in processability.

[0005]In the case of the method of the aforementioned \*\*, it is possible to be able to design an optical property freely and to manufacture a filter almost equivalent to a design. However, on the other hand, it is necessary to make very large the lamination number of sheets of a layer with refractive index difference, and there is a fault that a manufacturing cost becomes high. When you need a large area, since the thickness uniformity of high accuracy is required over a whole surface product, manufacture is

difficult.

[0006]In the case of the method of the aforementioned \*\*, the processability of the method of \*\* improves. However, although there is a steep absorption feature like the method of \*\*, the problem which has absorption also in a red portion and where a filter looks blue does not change.

[0007]As for the method of the aforementioned \*\*, much coloring matter, such as a phthalocyanine system, a nickel complex system, an azo compound, a poly methine system, a diphenylmethane system, a triphenylmethane series, and a quinone system, is used as an infrared absorption pigment. However, the many have problems, like absorption is insufficient or there is absorption of specific wavelength in a visible region.

[0008]In recent years, the near infrared ray emitted from that front face may cause malfunction of a remote control etc., and, as for PDP currently developed as a display of a thin type big screen, to install the infrared absorption filter which cuts this near infrared ray in a front face is needed. However, also in the infrared cutoff filter for this PDP, the actual condition is not having reached demand sufficient with the infrared absorption filter of the aforementioned \*\* - \*\*.

[0009]However, by the method of the aforementioned \*\*, when a JIIMONIUMU salt system compound is used for an infrared absorption pigment, the above-mentioned problem can be conquered and the filter absorption of a near infrared region is satisfied with the demand that there is little absorption in a visible region of a filter, greatly can be obtained. The performance for which it was suitable also as an infrared absorption filter for PDP can be obtained.

[0010]However, when the filter using a JIIMONIUMU salt system compound is neglected under an elevated temperature and humidification for a long time, absorption becomes small, or specific absorption appears in a visible region, and there is a problem of changing to yellowish green. Using the polyester system resin which made glass transition temperature high moderately as this measure is proposed. for example, aromaticdiol specific to a special playback common No. 838855 [ nine to ] gazette, and JP,11-116826,A -- more than 10mol% -- what mixed the infrared absorption pigment to the polyester resin which carried out copolymerization is illustrated. However, in the composition range using the aforementioned aromaticdiol. Conversely, since glass transition temperature becomes high too much, when copolymerized polyester resin was mixed with near-infrared absorption color matter and a solvent and a base film is coated, There is a problem of causing degradation of environmental stability for the remains solvent according to the shortage of dry in that desiccation takes time \*\*\*\*, and a film curling after spreading desiccation. Into said copolymerized polyester resin, the solubility in the inside of a solvent becomes low, and there are some which do not bear coating fitness.

[0011]The purpose of this invention has steep absorption in a near infrared region, and there are the absorptivity and absorption width of a near infrared region in the light transmittance state of a visible region providing an infrared absorption filter with good environmental stability, processability, and productivity highly greatly.

[0012]

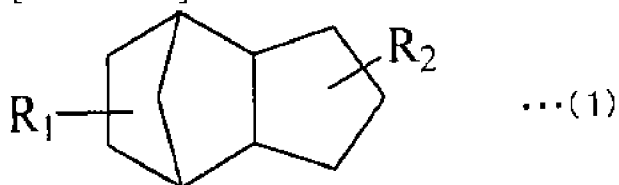
[Means for Solving the Problem]The infrared absorption filter which this invention was made in view of the above situations, and was able to solve said technical problem is as follows.

[0013]An invention of the 1st of this invention is the infrared absorption filter which laminated an infrared absorption layer which makes an infrared absorption pigment and polymer resin a main constituent to a transparent base material, A JIIMONIUMU salt compound is contained at least as said infrared absorption pigment, an alicycle fellows diol component said polymer resin is indicated to be by

a general formula (1) -- more than 60mol% -- it is an infrared absorption filter, wherein it is the polyester resin which carried out copolymerization and glass transition temperature is 85-130 \*\*.

[0014]

[Formula 4]

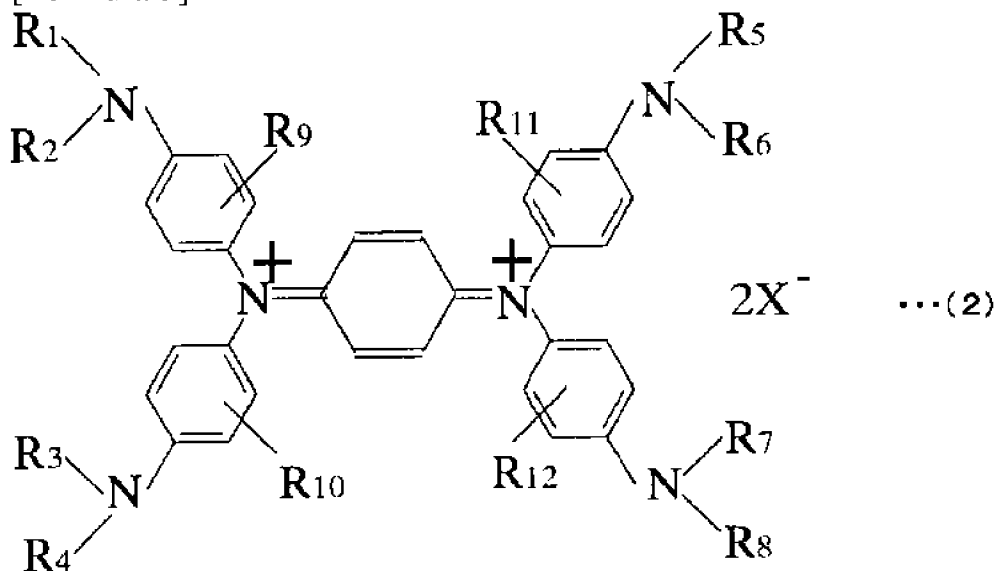


[0015](the inside of a formula,  $R_1$ , and  $R_2$  -- a hydroxyl group, the hydroxy alkylene group of the carbon numbers 1-8, and/or the hydroxy alkylene group of the carbon numbers 1-4 -- ARUKIRENOKISHIDO -- 1-10-mol% -- the added basis is shown.)

[0016]The 2nd invention is an infrared absorption filter with which a JIIMONIUMU salt compound given in the 1st invention is characterized by having the structure shown by a general formula (2).

[0017]

[Formula 5]



[0018](Among the formula,  $R_1 - R_8$  express a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, an aralkyl group, and an alkynyl group, may be the same respectively or may differ.)  $R_9 - R_{12}$  express a hydrogen atom, a halogen atom, an amino group, an amide group, a cyano group, a nitro group, a carboxylic acid group, and an alkyl group, may be the same respectively or may differ. What can combine a substituent by  $R_1 - R_{12}$  may have a substituent.  $X^-$  expresses negative ion.

[0019]The 3rd invention is an infrared absorption filter given in the invention of the 1st or 2 further characterized by the thing of a phthalocyanine system compound and a nickel complex system compound for which a kind is used at least as said infrared absorption pigment.

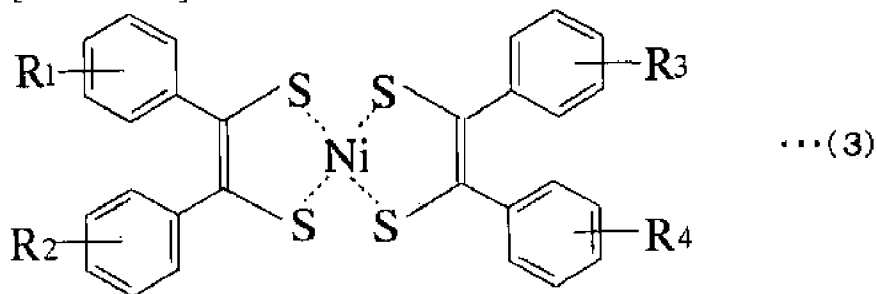
[0020]The 4th invention is an infrared absorption filter, wherein a phthalocyanine system compound given in the 3rd invention is a fluorine-containing phthalocyanine system compound.

[0021]The 5th invention is an infrared absorption filter given in an invention of the 3rd or 4 to which said nickel complex system compound is characterized by having the structure shown by a general

formula (3).

[0022]

[Formula 6]



[0023](R<sub>1</sub> - R<sub>4</sub> express a hydrogen atom, a halogen atom, an alkyl group, an alkoxy group, an aryl group, an aralkyl group, and an amino group among a formula.)

[0024]In the 6th invention, the compounding ratio of the infrared absorption pigment in said infrared absorption layer receives JIIMONIUMU salt compound 1.0 weight section, It is an infrared absorption filter given in the invention of the 3rd thru/or 5 being 0.5 to phthalocyanine system compound 0.0 weight section, and 1.0 to nickel complex system compound 0.0 weight section.

[0025]The 7th invention is an infrared absorption filter given in an invention of the 1st thru/or 6, wherein said infrared absorption layer is laminated by transparent base material with a coating method.

[0026]The 8th invention is an infrared absorption filter given in an invention of the 1st thru/or 7, wherein said transparent base material is polyester film.

[0027]The 9th invention is an infrared absorption filter given in an invention of the 1st thru/or 8 which specific gravity of polyester resin is in the range of 1.05-1.35, and is characterized by solubility of an infrared absorption pigment being 1 % of the weight or more in said infrared absorption layer.

[0028]The 10th invention is an infrared absorption filter given in an invention of the 1st thru/or 9, wherein the amount of residual solvents of said infrared absorption layer is 5.0 or less % of the weight.

[0029]The 11th invention is an infrared absorption filter given in an invention of the 1st thru/or 10, wherein glass transition point temperature of said polyester resin is 85-130 \*\*.

[0030]The 12th invention is an infrared absorption filter given in an invention of the 1st thru/or 11 having an antireflection layer in the outermost layer.

[0031]The 13th invention is an infrared absorption filter given in the 1st having an anti-glare treatment layer in the outermost layer thru/or 12.

[0032]The 14th invention is an infrared absorption filter installing a filter given in an invention of the 1st thru/or 13 in a front face of a plasma display.

[0033]

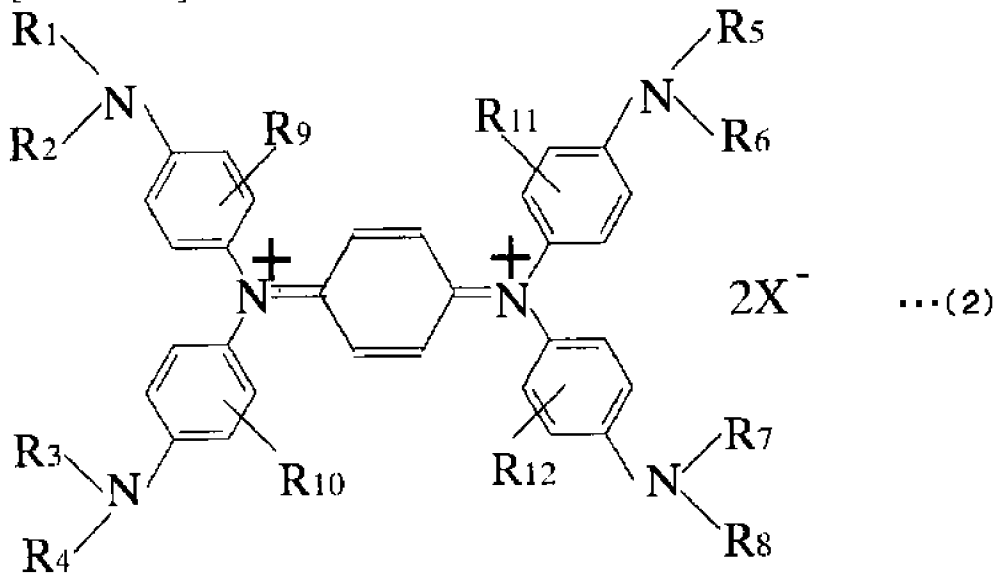
[Embodiment of the Invention]The infrared absorption filter of this invention is carrying out composition which laminated the infrared absorption layer which makes an infrared absorption pigment and polymer resin a main constituent to the transparent base material. Hereafter, the embodiment in the infrared absorption filter of this invention is described.

[0034]In the infrared absorption filter of this invention, it is required to use a JIIMONIUMU salt compound at least as an infrared absorption pigment. The thing of the structural formula which is shown especially by a general formula (2) anything greatly [ absorption of a near-infrared region ] as for it although it is good if the JIIMONIUMU salt compound to be used has high visible light transmittance is

preferred.

[0035]

[Formula 7]



[0036](Among the formula,  $R_1 - R_8$  express a hydrogen atom, an alkyl group, an aryl group, an alkenyl group, and an aralkyl group, may be the same respectively or may differ.)  $R_9 - R_{12}$  express a hydrogen atom, a halogen atom, an amino group, an amide group, a cyano group, a nitro group, a carboxyl group, and an alkyl group, may be the same respectively or may differ. What can combine a substituent by  $R_1 - R_{12}$  may have a substituent.  $X^-$  expresses negative ion.

[0037]In  $R_1$  of the above-mentioned general formula (2) -  $R_8$ , as an alkyl group, A methyl group, an ethyl group, n-propyl group, an iso-propyl group, n-butyl group, An iso-butyl group, t-butyl group, n-amyl group, n-hexyl group, n-octyl group, 2-hydroxyethyl group, 2-cyanoethyl group, 3-hydroxypropyl group, 3-cyanopropyl group, methoxy ethyl group, and ethoxyethyl group, a butoxyethyl group, etc. are illustrated. As an aryl group, a phenyl group, a fluorophenyl group, a chlorophenyl group, a tolyl group, diethylaminophenyl, a naphthyl group, etc. are mentioned, and a vinyl group, a propenyl group, a butenyl group, a pentenyl group, etc. are mentioned as an alkenyl group. As an aralkyl group, benzyl, p-fluorobenzyl, p-chlorophenyl group, a phenylpropyl group, a naphthyl ethyl group, etc. are mentioned.

[0038]As for  $R_9$  of a general formula (2) -  $R_{12}$ , hydrogen, fluoride, chlorine, bromine, a diethylamino group, a dimethylamino group, a cyano group, a nitro group, a methyl group, an ethyl group, a trifluoromethyl group, etc. are mentioned. As for  $X^-$ , a fluorine ion, a chloride ion, a bromine ion, iodine ion, perchlorate ion, hexafluoro antimononic acid ion, hexa fluorophosphoric acid ion, tetrafluoroboric acid ion, etc. are mentioned. However, in this invention, it is not limited to an above mentioned thing.

[0039]An infrared absorption pigment used by this invention has a still more preferred thing of a phthalocyanine system compound and a nickel complex system compound other than the aforementioned JIIMONIUMU salt compound for which a kind is used together at least. Although in particular a phthalocyanine system compound and/or a thio nickel series complex compound that are used by this invention are not regulated, it is preferred to compensate absorption of a near infrared

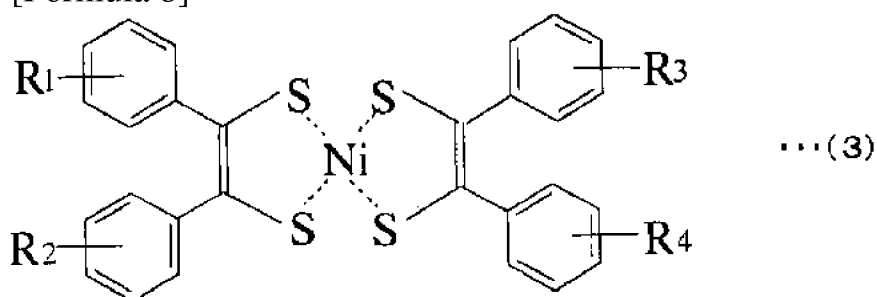
region of said JIIMONIUMU salt compound.

[0040]As a phthalocyanine compound, a fluorine-containing phthalocyanine compound is preferred. As an available commercial item, Excolor IR1 by NIPPON SHOKUBAI Co., Ltd., IR2, IR3, IR4, TX-EX 805K, TX-EX 810K, TX-EX 811K, TX-EX 812K, etc. are mentioned. Especially, IR1 and especially TX-EX 811K are preferred.

[0041]As a thio nickel complex system compound, a thing of a structural formula expressed with a general formula (3) is preferred. As a commercial item, SIR-128 by Mitsui Chemicals, Inc., SIR-130, SIR-132, SIR-159, etc. are mentioned. Especially, SIR-128 and especially SIR-159 are preferred.

[0042]

[Formula 8]



[0043](R<sub>1</sub> - R<sub>4</sub> express a hydrogen atom, a halogen atom, an alkyl group, an alkoxy group, an aryl group, an aralkyl group, and an amino group.)

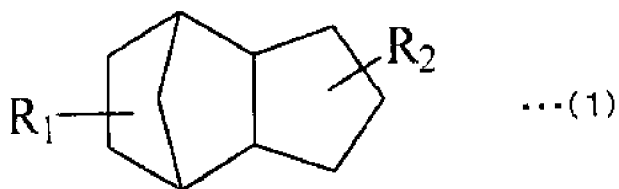
[0044]A compounding ratio of said infrared absorption pigment which an infrared absorption layer of an infrared absorption filter of this invention is made to contain, To JIIMONIUMU compound 1.0 weight section, 0.5 to fluorine-containing phthalocyanine system compound 0.0 weight section, It has steep absorption in a near infrared region that it is 1.0 to nickel complex system compound 0.0 weight section, and an absorptivity and absorption width of a near infrared region are large, and more preferred from a point which makes the light transmittance state of a visible region high.

[0045]Polymer resin which is a main constituent of an infrared absorption layer in this invention is polyester resin which consists of polyvalent carboxylic acid and polyhydric alcohol. As polyvalent carboxylic acid, the following are specifically illustrated.

(1) Terephthalic acid, isophthalic acid, orthophthalic acid, 1,5-naphthalene dicarboxylic acid, 2,6-naphthalene dicarboxylic acid, diphenic acid, sulfoterephthalic acid, 5-sulfoisophtharic acid, 4-sulfophthalic acid, 4-sulfonaphthalene-2,7-dicarboxylic acid, 5 [4-sulfophenoxy] Aromatic-dicarboxylic-acid (2) p-oxybenzoic acid, such as isophthalic acid, sulfoterephthalic acid and/or those metal salt, and ammonium salt, Aromatic hydroxy acid (3) succinic acid, such as p-(hydroxyethoxy) benzoic acid, Aliphatic-dicarboxylic-acid (4) boletic acid, such as adipic acid, azelaic acid, sebacic acid, and dodecane dicarboxylic acid, Polyvalent carboxylic acid more than tervalence of unsaturation aliphatic dicarboxylic acid, such as maleic acid, itaconic acid, hexahydrophthalic acid, and tetrahydrophthalic acid, and alicyclic dicarboxylic acid (5) trimellitic acid, trimesic acid, pyromellitic acid, etc. [0046]It is required to use as an essential ingredient alicyclic dicarboxylic acid shown by a general formula (1) as polyhydric alcohol, and to carry out copolymerization of said alicyclic dicarboxylic acid component to more than 60mol% polyester resin.

[0047]

[Formula 9]



[0048]As alicyclic diols shown by a general formula (1), tricyclodecanedimethylol, a tricyclodecane JIECHI roll, tricyclodecane Zyro pyrrole, tricyclodecane dibutanol, dimethyl tricyclodecanedimethylol, etc. are mentioned.  $R_1$  and  $R_2$  of especially tricyclodecanedimethylol that is a methylol group are [ among these ] preferred.

[0049]As a polyhydric alcohol component of polyester resin which is a main constituent of the infrared absorption layer used by this invention, Besides the alicyclic diol component shown by a general formula (1), copolymerization of aliphatic polyhydric alcohol, alicyclic polyhydric alcohol, the aromatic polyhydric alcohol, etc. can be suitably carried out in [ of a polyhydric alcohol component ] not more than 40 mol %.

[0050]For example, as the above-mentioned aliphatic polyhydric alcohol, Ethylene glycol, propylene glycol, 1,3-propanediol, 2,3-butanediol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, neopentyl glycol, diethylene glycol, Dipropylene glycol, 2 and 2, 4-trimethyl 1, 3-pentanediol, Triol, tetraol, etc., such as aliphatic series diol, such as polyethylene glycols, polypropylene glycol, and polytetramethylene glycol, trimethylolethane, trimethylolpropane, glycerin, and pen \*\*\*\*\*-\*\*, can be illustrated.

[0051]As an alicyclic polyhydric alcohol class, 1,4-cyclohexanediol, An ethyleneoxide addition of 1,4-cyclohexane dimethanol, spiroglycol, hydrogenation bisphenol A, and hydrogenation bisphenol A and a propylene oxide addition, tricyclodecane diol, tricyclodecane dimethanol, etc. can be illustrated.

[0052]As an aromatic polyhydric alcohol class, paraxylene glycol, meta xylene glycol, An ethyleneoxide addition, a propylene oxide addition, etc. of an ethyleneoxide addition of orthoxyleneglycol, 1,4-phenyleneglycol, and 1,4-phenyleneglycol, bisphenol A, and bisphenol A can be illustrated.

[0053]The lactone system polyester polyol which are produced by carrying out ring opening polymerization of the lactone, such as epsilon-caprolactone, as other polyhydric alcohol can be illustrated.

[0054]A monofunctional monomer may be introduced into polyester resin in order to block a polar group of an end of said polyester resin besides these.

[0055]As a monofunctional monomer, benzoic acid, chlorobenzoic acid, bromobenzoic acid, Para hydroxybenzoic acid, sulfobenzonic acid monoammonium salt, sulfobenzonic acid monosodium salt, Cyclohexyl aminocarbonyl benzoic acid, n-dodecylamino carbonyl benzoic acid, Tasha RUBUCHIRU benzoic acid, naphthalene carboxylic acid, 4-methylbenzoic acid, 3-methylbenzoic acid, salicylic acid, thiosalicylic acid, phenylacetic acid, Monoalcohol, such as monocarboxylic acid, such as acetic acid, propionic acid, butanoic acid, isobutyric acid, octanecarboxylic acid, lauryl acid, stearylacid, and these lower alkyl ester, or fatty alcohol, aromatic alcohol, and alicyclic diols alcohol, can be used.

[0056]aromatic diol specific to a special playback common No. 838855 [ nine to ] gazette, and JP,11-116826,A -- more than 10mol%, although polyester resin which carried out copolymerization is indicated, In this invention, it found out excelling in using as more than 60mol% polyester resin with copolymerization alicyclic diol shown by a general formula (1) extremely in respect of solvent solubility and coating fitness.

[0057]When said alicyclic diol is less than [ 60mol% ], solvent solubility improves and it

becomes easy to coat, but glass transition temperature of copolymerized polyester resin will fall, and environmental stability at the time of mixing an infrared absorption pigment will deteriorate. As for a maximum of the amount of copolymerization of an alicycle fellows diol component shown by a general formula (1) in this invention, it is preferred to consider it as less than [ 95mol% ]. In the case of beyond 95mol%, since there is a tendency which it is hard to go up a degree of polymerization of copolymerized polyester resin, and becomes very weak as a result, it is not desirable.

[0058]at this invention, glass transition temperature of copolymerized polyester resin used as carrier fluid of near-infrared absorption color matter needs to be more than operating assurance temperature of apparatus using an infrared absorption filter in order to raise weatherability -- it is -- \*\*

[0059]A JIIMONIUMU salt compound which is an infrared absorption pigment as glass transition temperature is below apparatus service temperature reacts to copolymerized polyester itself, or reacts to other infrared absorption pigments distributed in copolymerized polyester. Under humidification, in copolymerized polyester, absorption of moisture under open air, etc. becomes large, and degradation of an infrared absorption pigment and copolymerized polyester becomes large.

[0060]In this invention, glass transition temperature of copolymerized polyester resin which is a main constituent of an infrared absorption layer needs to be 85-130 \*\*, and is 90-110 \*\* preferably. When glass transition temperature is less than 85 \*\*, as stated previously, a JIIMONIUMU salt compound denaturalizes. When glass transition temperature exceeds 130 \*\*, copolymerized polyester resin will be dissolved in a solvent, and when it is going to coat on a transparent base material and is going to carry out sufficient desiccation, it will have to be made an elevated temperature, and a JIIMONIUMU salt compound will denaturalize. Degradation of other heat-resistant weak infrared absorption pigments is also caused. a case where it dries at low temperature -- drying time -- long -- not carrying out -- it does not obtain, therefore productivity worsens and it becomes impossible to make a cheap infrared absorption filter Sufficient desiccation may not be able to be performed.

[0061]As for an infrared absorption filter of this invention, it is preferred that the amount of residual solvents of an infrared absorption layer is 5.0 or less % of the weight. When an infrared absorption layer is formed with a coating method of a solvent system, even if residual solvent volume exceeds 5.0 % of the weight, for appearance, it is dry, and even if it has not generated blocking etc., an apparent glass transition temperature falls remarkably. When a JIIMONIUMU salt compound is especially used as an infrared absorption pigment and it is neglected under an elevated temperature and humidification for a long time, JIIMONIUMU salt system coloring matter denaturalizes and there is a problem that a filter will become yellowish green.

[0062]In this invention, it is preferred that residual solvent volume of an infrared absorption layer is especially 0.05 to 3.0 % of the weight. Although the denaturation of near-infrared absorption color matter when residual solvent volume neglects it under high-humidity/temperature in less than 0.05 % of the weight for a long time becomes small, near-infrared absorption color matter denaturalizes easily with heat required in order to carry out to less than 0.05% of the weight.

[0063]In order to carry out residual solvent volume of an infrared absorption layer to 5.0 or less % of the weight, it is required to satisfy simultaneously a drying condition of following formula (4) - (6). a unit of a factor used by following formula (4) - (6) -- a wind speed -- m/-- a second -- hot blast temperature -- \*\* and drying time -- a part and coat thickness -- mum -- it is .

Wind-speed x(hot-blast-temperature-20) x drying time / coat thickness >48 -- (4)

Hot blast temperature: >=80 \*\* -- (5)

Drying time:  $\leq 60$  minutes -- (6)

[0064]In this invention, as copolymerized polyester resin used for an infrared absorption layer, specific gravity is in the range of 1.05-1.35, and that whose solubility of the aforementioned infrared absorption pigment is 1 % of the weight or more is preferred.

[0065]As resin which it is preferred that it is a high polymer film as for a transparent base material of an infrared absorption layer of this invention, and constitutes a film, Although a polyester system, acrylic, a cellulose type, a polyethylene system, a polypropylene system, a polyolefin system, a polyvinyl chloride system, polycarbonate, a phenol system, urethane system resin, etc. are mentioned, it is not limited in particular. Especially, polyester system resin, such as polyethylene terephthalate from viewpoints of an environmental impact, cost performance, etc., polybutylene terephthalate, the polyethylene 2, and 6-naphthalate, is preferred. Especially, especially polyethylene terephthalate (it abbreviates to PET henceforth) is preferred. Hereafter, PET is mentioned as an example and explained in detail.

[0066]Manufacture of polyethylene terephthalate resin uses terephthalic acid and ethylene glycol as a starting material, Either a publicly known direct polymerization method which carries out a polycondensation through an esterification reaction, or a publicly known ester interchange method which uses dimethyl terephthalate and ethylene glycol as a starting material, and carries out a polycondensation through an ester exchange reaction can be used. In the case of a direct polymerization method, as a thing made to contain in polyethylene terephthalate resin, A polycondensation catalyst ( $\text{Sb}_2\text{O}_3$ , Sb glycolate, etc.), Adhesion improving agents (alkali metal salt of glycol fusibility, alkaline earth metal salt, etc.) at the time of manufacturing an unstretched film using a heat stabilizing agent (P systems, such as trimethyl phosphate compound) and an electrostatic seal-of-approval method are mentioned. In the case of an ester interchange method, transesterification catalysts (acetate, such as Mg, Ca, Zn, and Mn etc.) other than the above-mentioned compound are required. When  $\text{Sb}_2\text{O}_3$  is especially used as a polycondensation catalyst, at the time of a polymerization and/or manufacture of an unextended PET film, it is returned to the metal Sb and  $\text{Sb}_2\text{O}_3$  deposits easily as an aggregate in a film surface. Since this is set to one of the causes of an optical fault in a film, it is preferred to reduce content of  $\text{Sb}_2\text{O}_3$  as much as possible in the range which does not make polycondensation time remarkably late.

[0067]In order to carry out a foreign matter with a size of not less than 20 micrometers below  $10 \text{ [}/\text{m} \text{ ]}^2$  per unit area of a film into a PET film, It is preferred to be referred to as 50-250 ppm by using content of  $\text{Sb}_2\text{O}_3$  in polyethylene terephthalate resin as a Sb element, 50-200 ppm is still more desirable especially preferred, and it is 70-150 ppm. In polyethylene terephthalate resin, although an inert particle and internal deposit particles are made to contain smoothability grant etc. for the purpose generally, a point of raising transparency and reducing the above-mentioned foreign matter to these particles need not making it contain on parenchyma. If particles are not contained on parenchyma, for example an inorganic particle will be mentioned as an example, content of an inorganic particle in a film means being content smaller than a detection limit at the time of fluorescence X rays analyzing.

[0068]An aperture (95% cut) performs filtration treatment with the filter made from Naslon of 7 micrometers or less, or polyethylene terephthalate resin after polycondensation completion, When extruding melting resin in cooling water to strand shape, filtration treatment (aperture: 1 micrometer or less) of the cooling water is carried out beforehand, And it is preferred to consider it as a room which sealed this process, and to reduce the foreign matter of 1 micrometers or more in environment with a

high efficiency particulate air filter, although a foreign matter with a size [ in polyethylene terephthalate resin used as a raw material of a base film ] of not less than 20 micrometers is carried out below  $10 \text{ [m]}^2$  per unit area of a film.

[0069]Limiting viscosity of polyethylene terephthalate resin has the preferred range of 0.45 - 0.70 dl/g. It is 0.50 - 0.67 dl/g still more preferably, and is 0.55 - 0.65 dl/g especially preferably. If limiting viscosity is lower than 0.45 dl/g, fractures will occur frequently at the time of film manufacture, and the strong ductility characteristic will become insufficient. On the other hand, if larger than 0.70 dl/g, it becomes large, high precision filtration for tailing becomes difficult, and filter pressure rise is not preferred.

[0070]After fully carrying out vacuum drying of the polyethylene terephthalate resin which does not contain an inert particle and internal deposit particles substantially, an extruder is supplied, at about 280 \*\*, melt extruding is carried out to a sheet shaped, cooling solidification is carried out to it, and an unextended PET sheet is produced. Under the present circumstances, in order to remove a foreign matter contained in resin at arbitrary places where melting resin was kept at about 280 \*\* in order to remove further a foreign matter contained in polyethylene terephthalate resin, said high precision filtration is performed.

[0071]Although limitation in particular is not carried out, a filtering medium used for high precision filtration of melting resin, In the case of a filtering medium of a stainless steel sintered compact, it is suitable to carry out a foreign matter with a size of not less than 20 micrometers of a big and rough foreign matter resulting from a catalyst in raw material polyethylene terephthalate resin, an additive, a falling object from a reacting can wall, and an external contamination thing, a high-melting point organic matter, etc. below  $10 \text{ [m]}^2$  per unit area of a film. It is preferred that filtration grain size (95% of initial filtration efficiency) of a filtering medium used for high precision filtration of melting resin shall be 15 micrometers or less. If filtration grain size of a filtering medium exceeds 15 micrometers, it will be easy to become insufficient removing of a not less than 20-micrometer foreign matter. When filtration grain size (95% of initial filtration efficiency) performs high precision filtration of melting resin using a filtering medium of 15 micrometers or less, productivity may fall, but there are few optical faults and they are very important for obtaining a PET film excellent in transparency.

[0072]A publicly known method of quenching and using as a sheet is applicable, extruding melting resin from a dice on a rotary cooling drum at a sheet shaped, and sticking sheet-shaped melt to a rotary cooling drum by electrostatic seal-of-approval contact printing as a method of cooling an unstretched film.

[0073]As for a high polymer film used as a transparent base material of an infrared absorption filter of this invention, it is preferred that it is the film extended to at least 1 shaft orientations, and it is preferred that it is especially a biaxially oriented film. A biaxially oriented film is manufactured on the following conditions.

[0074]It extends so that an obtained unstretched film may be divided into at least two or more steps at a longitudinal direction with the roll heated at 80-120 \*\* and the total vertical draw magnification may be 2.5 to 5.0 times, and a uniaxial orientation PET film is obtained. An end of a film is grasped with a clip, and it leads to a hot wind zone heated by 80-180 \*\*, and extends 2.5 to 5.0 times crosswise. This biaxial stretching may be performed instead of said serial biaxial-stretching method for the purpose of reduction of a crack with a roll by a simultaneous biaxial-stretching method driven with a linear motor system in a tenter. A certain simultaneous biaxial-stretching method from the former may be used. It leads to a 200-

240 \*\* heat treating zone succeeding, heat treatment for 1 to 60 seconds is performed, and crystal orientation is made to complete. In this heat treatment process, 3 to 10% of relaxation processing may be performed to the cross direction and/or a longitudinal direction if needed.

[0075]It is preferred to make at least one side of the aforementioned biaxial orientation PET film laminate a polymers easy-bonding layer. Polymers easy-bonding layers are the arbitrary stages in the above-mentioned film manufacturing process, and it is preferred to make it apply and dry and to make coating liquid of polymers easily-adhesive resin which becomes at least one side of a PET film from water solubility or water dispersibility resin laminate.

[0076]Although the usual application process, i.e., a process which carry out biaxial stretching and is applied to a base film which carried out heat setting, may be sufficient as a process of applying the above-mentioned aqueous coating liquid, it is preferred. [ of the in-line coat method applied into a manufacturing process of this film ] It applies to a base film before crystal orientation is completed still more preferably. It is effective in reducing a foreign matter adhering to a film surface to control an air cleanliness class (particle several of 0.5micro or more/ft<sup>3</sup>) in the air in an application process with a high efficiency particulate air filter after unstretched film creation to become the class 100,000.

[0077]When drying and extending after applying the above-mentioned coating liquid to a polyester film substrate after un-extending or uniaxial stretching, it is important to select temperature and time which remove only parts for a solvent, such as water, in a drying process after spreading and when crosslinking reaction of a coating layer does not advance. As for drying temperature, it is preferred to carry out at 70-140 \*\*, and although drying time is adjusted according to coating liquid and coverage, 3000 or less are preferred as a temperature product of temperature (\*\*) and time (second).

[0078]It is desirable especially preferred that it is 30 or less % of the weight, and solids concentration in aqueous coating liquid is 10 or less % of the weight. A film by which this aqueous coating liquid was applied and dried is led to a tenter for extension and heat setting, is heated there, forms a stable tunic by heat crosslinking reaction, and turns into a biaxial orientation lamination PET film. In order to acquire good adhesion with an infrared absorption layer, it is preferred to carry out coating so that it may be not less than 100 \*\* in a heat treatment process, it may heat-treat for more than 1 minute and it may become more than 0.05g/[m]<sup>2</sup> about coverage of an easy-bonding layer after heat treatment.

[0079]A coating method of the above-mentioned aqueous coating liquid can be performed by a publicly known method. For example, the reverse roll coat method, the gravure coating method, the kis coat method, The roll brush method, a spray coating method, the air knife coat method, the wire barbershop coat method, a pipe doctor process, the impregnating coat method, the curtain coat method, etc. are mentioned, it is independent or these methods can be combined.

[0080]Although the above-mentioned polymers easily-adhesive resin in particular is not limited, aquosity polyester resin, aqueous polyurethane resin, an aquosity acrylic resin, acrylic acid graft system polyester resin, maleic acid graft system polyester resin, etc. are mentioned, for example. Polymer resin and maleic acid graft system polyester resin especially which make the main constituents aforementioned copolymerized polyester system resin and polyurethane resin, It excels also in an adhesive property with an antireflection layer and an anti-glare treatment layer which are excellent in a PET film of a substrate, or an adhesive property with an infrared absorption layer, and are laminated by the outermost layer of an infrared absorption filter, and is suitable from having still higher transparency. Therefore, in the surface which laminates an antireflection layer or an anti-glare treatment layer of a PET film of the surface which laminates an infrared absorption layer of a PET film of a substrate, and a

substrate. It is preferred to provide an easy-bonding layer which consists of polymer resin and/or maleic acid graft system polyester resin which make the main constituents an aforementioned polymers easy-bonding layer especially copolymerized polyester system resin, and polyurethane resin.

[0081]In aqueous coating liquid used for an easy-bonding layer of a biaxial orientation lamination PET film which is a transparent base material of an infrared absorption filter of this invention. Since heat crosslinking reaction is promoted, a catalyst may be added, for example, various chemicals, such as mineral matter, salts, an organic substance, an alkaline substance, acid, and a metal-containing organic compound, can use. In order to adjust the pH of solution, an alkaline substance or acid may be added.

[0082]When applying the above-mentioned aqueous coating liquid to the base film surface, in order to raise wettability to this film and to carry out the coat of the coating liquid uniformly, initial-complement use of a publicly known anionic active agent and a nonionic surface-active agent can be carried out. A solvent used for coating liquid may be mixed until a rate of occupying alcohols other than water, such as ethanol, isopropyl alcohol, and benzyl alcohol, to all the coating liquid will be less than 50 % of the weight. As long as it is less than 10 % of the weight, it may mix in the range which can dissolve organic solvents other than alcohols. However, as for the sum total of alcohols and other organic solvents, it is preferred among coating liquid to consider it as less than 50 % of the weight.

[0083]If an addition of an organic solvent is less than 50 % of the weight, while drying property will improve at the time of spreading desiccation, as compared with a case of only water, there is an effect of improvement in appearance of a coating film. If 50 % of the weight is exceeded, in order a vapor rate of a solvent will be quick, a concentration change of coating liquid will happen into coating, viscosity will rise and for coating nature to fall, there is a possibility of causing an appearance defect of a coating film, and danger, such as a fire, is also considered further.

[0084]Since particles aiming at smoothability grant etc. are not contained in a base film in this invention, It is preferred from points, such as the handling nature (slide nature, volume nature, blocking resistance) of a film, abrasion resistance, and scratch-proof nature, to make particles contain in the above-mentioned aqueous coating liquid, and to make a moderate projection form in the easy-bonding layer surface. As an example of this particle, calcium carbonate, calcium phosphate, silica, Organic particles, such as inorganic particles, such as kaolin, talc, a titanium dioxide, alumina, barium sulfate, calcium fluoride, lithium fluoride, zeolite, and a molybdenum sulfide, crosslinked polymer particles, and a calcium oxalate, can be mentioned. Also in these, since polyester resin and a refractive index can obtain a film which has the neighborhood and high transparency comparatively, a silica particle is the most preferred.

[0085]As for mean particle diameter of particles contained in the above-mentioned aqueous coating liquid, 0.01-1.0 micrometer is preferred, and especially its 0.03-0.5 micrometer or less is preferred. When mean particle diameter exceeds 1.0 micrometer, a film surface carries out surface roughening and there is a tendency for the transparency of a film to fall. On the other hand, mean particle diameter becomes insufficient [ the slide nature of a film, volume nature, blocking nature, etc. ] easily in less than 0.01 micrometer.

[0086]0.01 to 60 % of the weight is preferred, 0.05 to 30 % of the weight is still more desirable still more preferred, and a particle content in the above-mentioned easy-bonding layer is 0.1 to 10 % of the weight. When a particle content in an easy-bonding layer exceeds 60 % of the weight, the transparency of a film gets worse easily and easy adhesiveness may be spoiled further. On the other hand, a particle content in an easy-bonding layer becomes insufficient [ the slide nature of a film, volume nature,

blocking nature, etc. ] easily in less than 0.01 % of the weight.

[0087]Into an easy-bonding layer, two or more kinds of said particles may be blended, and that from which particle diameter differs by particles of the same kind may be used together. Anyway, it is preferred to satisfy a range which mean particle diameter of the whole particle and total content described above.

[0088]When applying the above-mentioned coating liquid, in order to remove a big and rough aggregate of particles in coating liquid, it is preferred to arrange a filtering medium so that precision filtration of the coating liquid may be carried out just before spreading.

[0089]That filtration grain size of a filtering medium for carrying out precision filtration of the coating liquid used by this invention shall be 25 micrometers or less (95% of initial filtration efficiency), It is suitable to make a bulky object which has an overall diameter of not less than 100 micrometers the surface and/or an inside of a polymers easy-bonding layer below  $3 \text{ [m]}^2$  per unit area of a polymers easy-bonding layer. Filtration grain size of a filtering medium cannot remove a big and rough aggregate enough in not less than 25 micrometers, After spreading desiccation, a big and rough aggregate spreads with extension stress, an easy-bonding layer is recognized as a not less than 100-micrometer aggregate, uniaxial stretching or when biaxial stretching is carried out, and many big and rough aggregates which were not able to be removed have a tendency which many optical faults generate as a result.

[0090]Especially if a type of a filtering medium for carrying out precision filtration of the coating liquid has the above-mentioned performance, it will not be limited, but a filament type, a felt type, and a mesh type are preferred, for example. Construction material of a filtering medium for carrying out precision filtration of the coating liquid has the removal performance of the above-mentioned big and rough aggregate, and if there is no \*\*\*\*\* in coating liquid about an adverse effect, limitation in particular will not be carried out, but construction material of stainless steel, polyethylene, polypropylene, nylon, etc. is preferred, for example.

[0091]In the above-mentioned aqueous coating liquid, various additive agents, such as a spray for preventing static electricity, an ultraviolet absorption inhibitor, a plasticizer, an antimicrobial agent, paints, and lubricant, may be mixed in the range which does not check easy adhesiveness and transparency in addition to particles.

[0092]50-300 micrometers is desirable especially preferred, and thickness of a biaxial-stretching lamination PET film which has the obtained easy-bonding layer is 100-250 micrometers. Film thickness becomes insufficient [ less than 50 micrometers / rigidity ], and is not preferred. On the other hand, if film thickness exceeds 300 micrometers, since a foreign matter used as an optical fault which exists in a film will increase and total light transmittance will be reduced, it is not desirable.

[0093]It is required for a foreign matter with a size of not less than 20 micrometers to be below  $10 \text{ [m]}^2$  per unit area of a film in a PET film which has said easy-bonding layer, and below eight-piece  $\text{[m]}^2$  is below six-piece  $\text{[m]}^2$  especially preferably preferably. If a foreign matter with a size of not less than 20 micrometers exceeds ten-piece  $\text{[m]}^2$ , a haze value of the whole film will go up and decline in total light transmittance will be caused. It also becomes a cause of an optical fault and is not desirable as an infrared absorption filter.

[0094]The following methods are preferred, when using polyethylene terephthalate resin as a raw material for films as explained above for example, in order for a foreign matter with a size of not less than 20 micrometers to carry out below  $10 \text{ [m]}^2$  per unit area of a film.

- (1) Make less than usual content of  $\text{Sb}_2\text{O}_3$  which is a polycondensation catalyst at the time of PET manufacture (to PET, 50-250 ppm is preferred as a Sb element, 50-200 ppm is still more desirable especially preferred, and it is 70-150 ppm).
- (2) Don't let me contain an inert particle and internal deposit particles on parenchyma.
- (3) An aperture (95% cut) performs filtration treatment with the filter made from Naslon of 5 micrometers or less, or polyethylene terephthalate resin after polycondensation completion, When you extrude melting resin in cooling water to strand shape, carry out filtration treatment (aperture: 1 micrometer or less) of the cooling water beforehand, and divide this process with a curtain, and remove the foreign matter of 1 micrometers or more in environment with a high efficiency particulate air filter.
- (4) Consider melting polyethylene terephthalate resin as high precision filtration (filtration grain size in 95% of an initial filtration efficiency of a filtering medium:  $\leq 15$ micrometer) at an extrusion process at the time of PET film manufacture.

[0095]As for a PET film used as a substrate of an infrared absorption filter of this invention, it is preferred that a haze value is 1.0% or less. It is 0.6% or less especially preferably 0.8% or less still more preferably. If a haze value exceeds 1.0%, since color definition of a scope which uses an infrared absorption filter which uses this PET film as a substrate will fall, it is not desirable. In order to make a haze value into 1.0% or less, as resin which adopts a means not to make an inert particle and internal deposit particles contain on parenchyma in the aforementioned film, and to remove the above-mentioned big and rough foreign matter, and constitutes a polymers easy-bonding layer further, It is effective to use polymer resin and/or maleic acid graft system polyester resin which make the main constituents copolymerized polyester system resin and polyurethane resin.

[0096]An infrared absorption layer is laminated on a film which laminated a polymers easy-bonding layer at least on one side of a biaxial orientation lamination PET film obtained above. An easily-adhesive side of a transparent high polymer film may be available for lamination of an infrared absorption layer, and a field without an easy-bonding layer may be available for it.

[0097]In order to raise the lightfastness of an infrared absorption filter of this invention further, an infrared absorption layer may be made to contain UV absorbent. In order to raise weatherability and solvent resistance further, polymer resin which distributes an infrared absorption pigment may be made to construct a bridge using a cross linking agent. In an infrared absorption layer of an infrared absorption filter of this invention, coloring matter of other type may be mixed if needed in the range which does not check an effect of this invention.

[0098]However, since both sides of a film become smooth by an infrared absorption layer when manufacturing an infrared filter which made both sides of a PET film laminate an infrared absorption layer, it becomes difficult to roll round to rolled form at the time of mass production. Then, it is preferred by making at least one side of said infrared absorption layer contain an inert particle, and making unevenness form in an infrared absorption layer surface to make handling characteristics, such as slide nature, volume nature, and blocking nature, improve. As for an inert particle, it is preferred to mix in polymer resin which distributes an infrared absorption pigment. As an inert particle, particles of metallic oxides whose mean particle diameter which is short wavelength from wavelength of visible light is 0.01-0.1 micrometer, such as silica and alumina, fluoro resin and acrylic resin, and polyester system resin can be used from a point of transparency. It is preferred to make an infrared absorption layer of an infrared absorption filter of this invention contain an ultraviolet ray absorbent in order to raise lightfastness. In an infrared absorption layer of an infrared absorption filter of this invention,

coloring matter of other type may be mixed if needed in the range which does not check an effect of this invention.

[0099]When laminating an infrared absorption layer at least on one side of a PET film of a substrate, it is preferred to make at least one side of a base film carry out spreading desiccation of the coating liquid which dissolved polymer resin with solvents, such as methyl ethyl ketone, a tetrahydrofuran, and toluene, and subsequently distributed an infrared absorption pigment. It is preferred to make an infrared absorption layer of an infrared absorption filter of this invention contain an ultraviolet ray absorbent in order to raise lightfastness. In an infrared absorption layer of an infrared absorption filter of this invention, coloring matter of other type may be mixed if needed in the range which does not check an effect of this invention.

[0100]When applying an infrared absorption layer to both sides of a base film, the method in particular is not limited, but a method [ like / next ] can be used as an example. For example, a method which coats both sides simultaneously and double-sided coincidence is made to dry by providing two or more coater heads on one coating line, or after coating one side and drying it first, a method of coating a rear face again and drying, etc. are mentioned.

[0101]As for an infrared absorption filter of this invention, it is preferred to laminate a metallic mesh conductive layer to the same field as an infrared absorption layer or an opposite side. By laminating a metallic mesh conductive layer, it becomes possible to remove harmful electromagnetic waves emitted from a display. As a metallic mesh conductive layer, textiles which used techniques, such as plating, for what performed an etching process and made a high metallic foil of electric conductivity mesh state, a mesh of the shape of textiles using a metal fiber, and the surface of a polymer fiber, and made metal adhere to them may be used.

[0102]As for a numerical aperture of a metallic mesh used for the above-mentioned electromagnetic wave absorption layer, when a case where it uses for a display use is taken into consideration, it is preferred to consider it as not less than 50%. If electric conductivity is high and stability is good, what kind of metal may be sufficient as metal used for said electromagnetic wave absorption layer, and it will not be limited in particular. Copper, nickel, tungsten, etc. are better than viewpoints of processability, cost, etc. preferably.

[0103]An infrared absorption filter of this invention may provide a hard court treating layer (HC) in the outermost layer for a scratch-proof nature improvement. As this hard court treating layer (HC), a simple substance or a mixed cross-linking resin hardened material layer is preferred in hardening resin, such as polyester system resin, urethane system resin, acrylic resin, melamine system resin, epoxy system resin, silicon system resin, and polyimide system resin.

[0104]The range of 1-50 micrometers is desirable still more preferred, and a range of this hard court treating layer's (HC)'s thickness is 2-30 micrometers. When thickness is thinner than 1 micrometer, scratch-proof nature becomes insufficient, speed of coating of resin for hard courts becomes remarkably slow in thickness over 50 micrometers, and it is not desirable in respect of productivity.

[0105]A method of making it impress and harden energies, such as heat, ultraviolet rays, and an electron beam, as a method of laminating a hard court treating layer (HC), after coating with the above-mentioned resin a field of an opposite hand of a field in which an infrared absorption layer of a PET film was provided by photogravure method, reverse method, a die method, etc. is preferred.

[0106]An infrared absorption filter of this invention may provide an anti-glare treatment layer (AG) in the outermost layer for improvement in visibility at the time of using for a plasma display etc. An anti-

glare treatment layer (AG) can be manufactured by forming unevenness in the surface for hardening resin with an embossing roll after coating and desiccation, and impressing and stiffening energies, such as this post heating, ultraviolet rays, and an electron beam. As said hardening resin, a simple substance or mixed things, such as polyester system resin, urethane system resin, acrylic resin, melamine system resin, epoxy system resin, silicon system resin, and polyimide system resin, are preferred.

[0107]When this invention infrared absorption filter is used for a display, in order to raise transmissivity of visible light further, an acid-resisting treating layer (AR) may be provided in the outermost layer. It is preferred to laminate material which has a different refractive index from a refractive index of a plastic film in this acid-resisting treating layer (AR) more than a monolayer or two-layer. In the case of layer structure, it is good to use material which has a refractive index smaller than a plastic film. When considering it as multilayer structure more than two-layer, it is preferred to choose material which has a refractive index smaller than this in a layer on this using material which has a bigger refractive index than a plastic film in a layer which adjoins a plastic film. As a material which constitutes such an acid-resisting treating layer (AR), Especially if organic materials or an inorganic material also satisfies a relation of the above-mentioned refractive index, will not be limited, but. For example,  $\text{CaF}_2$ ,  $\text{MgF}_2$ ,  $\text{NaAlF}_4$ , It is preferred to use dielectrics, such as  $\text{SiO}_2$ ,  $\text{ThF}_4$ ,  $\text{ZrO}_2$ , and  $\text{Nd}_2\text{O}_3$ ,  $\text{SnO}_2$ ,  $\text{TiO}_2$ ,  $\text{CeO}_2$ ,  $\text{ZnS}$ , and  $\text{In}_2\text{O}_3$ .

[0108]A dry coating process or wet coating processes, such as a photogravure method, a reverse method, and a die method, such as a vacuum deposition method, sputtering process, a CVD method, and the ion plating method, may be sufficient as this acid-resisting treating layer's (AR)'s laminating method.

[0109]In advance of lamination of this hard court treating layer (HC), an anti-glare treatment layer (AG), and an acid-resisting treating layer (AR), as pretreatment, Publicly known processing of corona discharge treatment, plasma treatment, sputter etching processing, electron-beam-irradiation processing, UV irradiation treatment, priming, easily-adhesive processing, etc. may be performed.

[0110]

[Example]Next, although the manufacturing method of the infrared absorption filter of this invention is explained in detail using an example, naturally it is not limited to this. Especially the "part" used by the example and the comparative example means a "weight section", unless it refuses. Evaluation of the weighted solidity used in this specification was based on the following method.

[0111](1) In the mixed solvent of the limiting viscosity 1,1,2,2-tetrachloroethane / phenol of polyester resin (weight ratio: 2/3), it asked from the solution viscosity in 30 \*\*.

[0112](2) With the optical fault sensing device explained below to the size of the foreign matter in a film, and a big and rough-among coating liquid aggregate, the optical fault optically recognized to be a size of not less than 50 micrometers was detected about 16 film pieces (250 mm x 250 mm).

(Detection principles of an optical fault) The fluorescent lamp of 20Wx2 lights is arranged in 400 mm of XY table lower parts as a floodlight, and a mask with a slit width of 10 mm is provided. If light is entered at 12 degrees, the perpendicular direction of the film plane measured the line top which connects a floodlight and an electric eye, and the angle to make, If an optical fault exists there, the portion will shine, it changes into an electrical signal with the CCD image sensor camera which has arranged the light volume to 500 mm of XY table upper parts, and the electrical signal is amplified and differentiated, a threshold level and a comparator compare, and the detecting signal of an optical fault is outputted. The position of the optical fault of the size which measured the size of the optical fault by the picture

procedure, and was set up in the video signal inputted from the CCD image sensor camera is displayed. [0113]The optical fault by a foreign matter and the optical fault by the big and rough aggregate in coating liquid were selected out of the detected defect parts using the above-mentioned optical fault sensing device, it cut off in the still more suitable size, and the size when it observed from the perpendicular direction to the film plane under the microscope with a scale was measured. In the case of the optical fault by a foreign matter, the overall diameter of the size of a foreign matter was measured, and it asked for the foreign matter with a size of not less than 20 micrometers with the number of per a film unit area ( $1\text{-m}^2$ ). In the case of the big and rough aggregate in coating liquid, the overall diameter of the big and rough aggregate was measured, and it asked for the foreign matter with a size of not less than 100 micrometers with the number of per the unit area ( $1\text{-m}^2$ ) of an easy-bonding layer.

[0114](3) According to haze value JIS-K7105, it measured using the hazemeter (model TC-H3Dby Tokyo Denshoku industrial company P).

[0115](4) It measured in the range with a wavelength of 1500-200 nm using the spectral characteristic recording spectrophotometer (the Hitachi U-3500 type).

[0116](5) After neglecting a sample for 500 hours under the atmosphere of the environmental stability temperature of 60 \*\*, and 95% of humidity, the spectral characteristic of the above-mentioned statement was measured.

[0117](Example 1)

(1) The coating liquid used for the polymers easy-bonding layer laminated to a transparent high polymer film was prepared in accordance with the following methods by adjustment this invention of the coating liquid for polymers easy-bonding layers. 95 copies of dimethyl terephthalate, 95 copies of dimethyl isophthalate, 35 copies of ethylene glycol, 145 copies of neopentyl glycol, 0.1 copy of zinc acetate, and 0.1 copy of antimonous oxide were taught to the reaction vessel, and the ester exchange reaction was performed over 3 hours at 180 \*\*. Next, after adding 6.0 copies of 5-sodium isophthalic acid and performing an esterification reaction over 1 hour at 240 \*\*, the polycondensation reaction was performed over 2 hours under decompression (13.3-0.267 hPa) at 250 \*\*, and the molecular weight 19,500 and polyester resin of 60 \*\* of softening temperatures were obtained.

[0118]The solution (Dai-Ichi Kogyo Seiyaku make: trade name Hellas TRON H-3) of self-bridge construction type polyurethane resin (B) containing the isocyanate group which blocked the 30% water dispersion of the obtained polyester resin (A) with 6.7 copies and sodium bisulfite 20% 40 copies, 44.3 copies and isopropyl alcohol for 0.5 copy and water Five copies, [ the catalyst for Hellas TRON (Cat64) ] Mix, respectively and further the solution of an anionic system surface-active agent 10% 0.6 copy, 1.8 copies and 1.1 copies of 4% water dispersions of the dry-process-silica particles B (the product made by Japanese Aerosil; Aerosil OX50, mean particle diameter of 500 nm, first [ an average of ] particle diameter of 40 nm) were added, and the 20% water dispersion of spherical-silica-particles A (Nissan Chemical Industries [, Ltd. ] make: snow textile OL, mean particle diameter of 40 nm) was used as coating liquid. (It is hereafter written as the coating liquid AB.)

[0119](2) When temperature up of the manufacture esterification reaction can of polyethylene terephthalate resin is carried out and 200 \*\* is reached, 0.017 weight sections and 0.16 weight sections of triethylamines were added for antimonous oxide as a catalyst, teaching and stirring the slurry which consists 86.4 weight sections and ethylene glycol of 64.4 weight sections in terephthalic acid. Subsequently, application-of-pressure temperature up was performed and the application-of-pressure esterification reaction was performed on gage pressure 0.34MPa and 240 \*\* conditions. then -- returning

the inside of an esterification reaction can to ordinary pressure -- magnesium acetate -- subsequently trimethyl phosphate 0.014 weight section was added 0.071 weight section 4 hydrate. furthermore -- carrying out temperature up to 260 °C over 15 minutes -- trimethyl phosphate -- subsequently sodium acetate 0.0036 weight section was added 0.012 weight section. The acquired esterification reaction output was transported to the polycondensation reaction can 15 minutes afterward, temperature up was gradually carried out from 260 °C to 280 °C under decompression, and the polycondensation reaction was performed at 285 °C. The cut size performed filtration treatment 95% after the end of a polycondensation reaction with the filter made from Naslon which is 5 micrometers. Melting resin was extruded in the cooling water pool from the nozzle, this strand shape polyethylene terephthalate resin was cut, and the PET chip was obtained. the obtained PET chip (A) -- 58 ppm and the amount of P are 40 ppm, and a color L value is [ limiting viscosity / 0.62 dl/g and Sb content / 56.2 and the color b value of 144 ppm and Mg content ] 1.6.

An inert particle and internal deposit particles were not contained on parenchyma.

[0120](3) The extruder was supplied, after using the above-mentioned PET chip (A) as a raw material for film production films of an easily-adhesive film and carrying out reduced pressure drying (1.33 hPa) at 135 °C for 6 hours. Under the present circumstances, filtration treatment was performed for melting resin using the sintering filtering medium made from stainless steel with a filtration grain size (95% of initial filtration efficiency) of 15 micrometers. subsequently, melting aggressiveness appearance of about 280 °C melting resin was carried out to the sheet shaped from the dice, on the metal cooling roller (chilled roll) maintained at the skin temperature of 20 °C, the seal of approval of the static electricity is carried out, quenching solidification was carried out, and the 1400-micrometer-thick unstretched film was obtained.

[0121]next, it extended so that it might come out using the roll group and infrared heater which had this unstretched film heated, it might heat at 100 °C, it might divide into two steps at a longitudinal direction by the roll group which has peripheral speed difference after that and the total vertical draw magnification might be 3.5 times, and the uniaxial orientation PET film was obtained.

[0122]Then, precision filtration of said coating liquid was carried out with the filtering medium made from felt type polypropylene with a filtration grain size (95% of initial filtration efficiency) of 25 micrometers, and it applied and dried on one side of said uniaxial orientation PET film by the reverse roll method. It controlled with the high efficiency particulate air filter so that the air cleanliness class (particle several of 0.5micro or more/ft<sup>3</sup>) in the air in an application process served as the class 100,000 after unextended cast film manufacture. Then, after grasping the end of the film with a clip and drying a coating layer for 20 seconds at 80 °C in the preheating zone of a tenter, it extended crosswise in the lateral orientation zone, and extended 4.0 times at 130 °C. Then, heat setting processing was performed at 240 °C, 3% of transverse relaxation processing was performed at 200 more °C, and the biaxial orientation PET film with a thickness of 100 micrometers which has an easy-bonding layer was obtained. Coverage was 0.10 g/m<sup>2</sup> as an amount of solid content. The biaxial orientation PET film which has the obtained easy-bonding layer, The overall diameter of the number of a not less than 100-micrometer foreign matter to which, as for a not less than 20-micrometer foreign matter, the overall diameter which does not contain particles on parenchyma in a film, but exists in a film exists in the surface and the inside of six-piece [1/m]<sup>2</sup> and an easy-bonding layer was three-piece [1/m]<sup>2</sup>.

[0123](4) Copolymerized polyester resin used as carrier fluid of the manufacture infrared absorption

pigment of copolymerized polyester resin for infrared absorption layers was manufactured in the following ways. In the autoclave provided with the thermometer and the agitator, Dimethyl terephthalate 136 weight sections Dimethyl isophthalate 58 weight sections Ethylene glycol 93 weight sections Tricyclodecane dimethanol 137 weight sections Antimonous oxide 0.09 weight section was taught, it heated for 180 minutes at 170-220 \*\*, and the ester exchange reaction was performed. Subsequently, temperature up of the temperature of the system of reaction was carried out to 245 \*\*, the reaction was continued for 180 minutes as 1.33-13.3 hPa of system pressures, and copolymerized polyester resin (A1) was obtained. As for the limiting viscosity of copolymerized polyester resin (A1), 90 \*\* and the specific gravity of 0.40 dl/g and glass transition temperature were 1.245.

[0124]The composition ratio of the constituent of copolymerized polyester resin (A1) by NMR analysis is acid component terephthalic acid. 71mol% isophthalic acid 29mol% alcohol component ethylene glycol 31mol% tricyclodecane dimethanol It was 69-mol%.

[0125](5) It stirred adding and heating a solvent, said copolymerized polyester resin (A1), and an infrared absorption pigment by presentation as shown in Table 1 in manufacture, next the flask of an infrared absorption filter, and an infrared absorption pigment and copolymerized polyester resin (A1) were dissolved. Dissolved resin was applied to the easy-bonding layer side of said easily-adhesive PET film substrate using the applicator whose gap is 100 micrometers, and was dried with the drying temperature of 90 \*\* for 1 hour. The thickness of the infrared absorption layer after desiccation was 25 micrometers, and residual solvent volume was 1 % of the weight.

[0126]An amorous glance in viewing of the obtained infrared absorption filter was dark grey. The spectral characteristic is shown in drawing 1. As shown in drawing 1, in the visible region from the wavelength of 400 nm to 650 nm, absorption was even, and the infrared absorption filter which has absorption steeply was obtained on the wavelength of not less than 700 nm. The haze value was high transparency very as small as 0.5%.

[0127]When the obtained infrared absorption filter was neglected in the temperature of 60 \*\*, and the atmosphere of 95% of humidity RH for 500 hours and the spectral characteristic was measured again, it became like drawing 2 and some color change was seen, but the near-infrared absorption feature was maintained. When the obtained filter had been arranged in the front face of a plasma display, there is no change of an amorous glance, and contrast improved, and radiation of a near infrared ray was also reduced.

[0128]

[Table 1]

材料		配合量 (重量部)
赤外線吸収色素	ジイモニウム塩系化合物 日本化薬社製 Kyasorb IRG-022	3. 2
	含フッ素フタロシアニン化合物 日本触媒社製 Excolor IR-1	0. 5
	ニッケル錯体系化合物 三井化学社製 SIR-159	1. 6
高分子樹脂	共重合ポリエステル樹脂(A1)	440
溶剤	メチルエチルケトン	490
	テトラヒドロフラン	490
	トルエン	490

[0129](Example 2) In manufacture of the infrared absorption filter of Example 1, except having changed into the presentation as shows the presentation of the coating liquid for infrared absorption layers in Table 2, it is the same method as Example 1, and the infrared absorption filter was obtained. The infrared absorption layer thickness after desiccation was 25 micrometers, and residual solvent volume was 1 % of the weight. The spectral characteristic is shown in drawing 3. When the obtained infrared absorption filter was neglected in the temperature of 60 \*\*, and the atmosphere of 95% of humidity RH for 500 hours and the spectral characteristic was measured again, it became like drawing 4 and some color change was seen, but the near-infrared absorption feature was maintained.

[0130]

[Table 2]

材料		配合量 (重量部)
赤外線吸収色素	ジイモニウム塩系化合物 日本化薬社製 Kyasorb IRG-022	3. 2
高分子樹脂	共重合ポリエステル樹脂(A1)	440
溶剤	メチルエチルケトン	490
	テトラヒドロフラン	490
	トルエン	490

[0131](Comparative example 1) As polymer resin for infrared absorption layers, except using copolymerized polyester resin (Toyobo Co., Ltd. make and Byran RV200, specific gravity 1.255, glass

transition temperature of 67 \*\*), the coating liquid for infrared absorption layers was adjusted like Example 1, and the infrared absorption filter was obtained. The infrared absorption layer thickness after desiccation was 25 micrometers. An amorous glance in viewing of the obtained infrared absorption filter was dark grey. The spectral characteristic is shown in drawing 5. As shown in drawing 5, in the visible region from the wavelength of 400 nm to 650 nm, absorption was even, and the infrared absorption filter which has absorption steeply was obtained on the wavelength of not less than 700 nm.

[0132]However, the obtained infrared absorption filter was neglected in the temperature of 60 \*\*, and the atmosphere of 95% of humidity RH for 500 hours, when the spectral characteristic was measured again, it became like drawing 6, and the color tone changed green and the near-infrared absorption feature got very bad.

[0133](Comparative example 2) Copolymerized polyester resin used as carrier fluid of an infrared absorption pigment was manufactured in the following ways. In the autoclave provided with the thermometer and the agitator, Dimethyl terephthalate 136 weight sections Dimethyl isophthalate 58 weight sections Ethylene glycol 105 weight sections Tricyclodecane dimethanol 98 weight-section antimonous oxide 0.09 weight section was taught, it heated for 180 minutes at 170-220 \*\*, and the ester exchange reaction was performed. Subsequently, temperature up of the temperature of the system of reaction was carried out to 245 \*\*, the reaction was continued for 180 minutes as 1.33-13.3 hPa of system pressures, and copolymerized polyester resin (A2) was obtained. As for the limiting viscosity of this copolymerized polyester resin, 80 \*\* and the specific gravity of 0.40 dl/g and glass transition temperature were 1.245.

[0134]The composition ratio of the constituent of the above-mentioned copolymerized polyester resin (A2) by NMR analysis is acid component terephthalic acid. 71mol% isophthalic acid 29mol% alcohol component ethylene glycol 49mol% tricyclodecane dimethanol It was 51-mol%.

[0135]As polymer resin for infrared absorption layers, except using the above-mentioned copolymerized polyester resin (A2), the coating liquid for infrared absorption layers was adjusted like Example 1, and the infrared absorption filter was obtained. The infrared absorption layer thickness after desiccation was 25 micrometers. An amorous glance in viewing of the obtained infrared absorption filter was dark grey. The spectral characteristic had the spectral characteristic almost equivalent to Example 1.

[0136]However, the obtained infrared absorption filter was neglected in the temperature of 60 \*\*, and the atmosphere of 95% of humidity RH for 500 hours, when the spectral characteristic was measured again, it became like drawing 7, and the color tone changed green and the near-infrared absorption feature got very bad.

[0137](Comparative example 3) Except using the copolymerized polyester resin (A2) used by the comparative example 1 as polymer resin for infrared absorption layers, the coating liquid for infrared absorption layers was adjusted like Example 2, and the infrared absorption filter was obtained. The infrared absorption layer thickness after desiccation was 25 micrometers. An amorous glance in viewing of the obtained infrared absorption filter was dark grey. The spectral characteristic is shown in drawing 8. As shown in drawing 8, in the visible region from the wavelength of 400 nm to 650 nm, absorption was even, and the infrared absorption filter which has absorption steeply was obtained on the wavelength of not less than 700 nm.

[0138]However, the obtained infrared absorption filter was neglected in the temperature of 60 \*\*, and the atmosphere of 95% of humidity RH for 500 hours, when the spectral characteristic was measured

again, it became like drawing 9, and the color tone changed to yellowish green.

[0139](Comparative example 4) Copolymerized polyester resin given [ as polymer resin for infrared absorption layers ] in Example 1 of a special playback common No. 838855 [ nine to ] gazette (A3; the glass transition temperature of 140 \*\*) Except using the limiting viscosity 0.42 and molecular weight Mw45000, the coating liquid for infrared absorption layers was adjusted like Example 1, and the infrared absorption filter was obtained. The infrared absorption layer thickness after desiccation was 25 micrometers. An amorous glance in viewing of the obtained infrared absorption filter was dark grey. The spectral characteristic had the spectral characteristic almost equivalent to Example 1. However, when the obtained infrared absorption filter was settled, it was curving. When the obtained infrared absorption filter was neglected in the temperature of 60 \*\*, and the atmosphere of 95% of humidity RH for 500 hours, the infrared absorption layer exfoliated thoroughly from the PET film of the substrate.

[0140]

[Effect of the Invention]The infrared absorption filter of this invention has wide large and absorption in a near-infrared region, and the light transmittance state of a visible region is high, and also excellent in environmental stability (even if it uses it an elevated temperature or under highly humid for a long time, there is little change of the spectral characteristic and a color tone). It has the advantage of not curling even if processability and productivity are good and settle. Therefore, it is suitable especially as optical instruments, such as a video camera and a display, especially an infrared absorption filter for plasma displays.

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